

Maine Healthy Beaches Program Risk Assessment Matrix

Scope and Application

A *Risk Assessment Matrix* (RAM) is a preliminary assessment of beach characteristics, activities, and water quality. The Maine Healthy Beaches (MHB) Program uses this risk-based ranking system to assess and classify coastal beaches and their management areas. This assessment helps beach managers gain a better understanding of the actual and potential pollution sources impacting the beach. The RAM will help define the typical “worst-case scenario” (i.e., when the risk of pollution is the greatest) resulting in unsafe bacteria levels at coastal swim beaches. Each beach or beach management area (BMA) is ranked based on a points grading system. A higher point score indicates a beach management area with a greater risk of bacterial pollution compared to areas with a lower point score. The number of points and associated ranking will help determine the beach’s “tier”¹ classification, and provide guidance on the best management course of action (monitoring frequency, posting a precautionary advisory following rainfall, the need to implement a more thorough sanitary survey, etc.).

The purpose of the RAM is to:

- Provide a preliminary assessment of potential and actual sources of bacterial pollution.
- Assist beach managers in making well-informed beach management decisions related to monitoring, assessment, and public notification of beach water quality conditions.
- Work in conjunction with routine monitoring, special studies, and sanitary survey work to build a profile of each BMA.
- Determine the need for an in-depth sanitary survey of the shoreline, adjacent watershed area(s), and offshore.

Beach Management Areas

A beach management area (BMA) is an entire beach or segment of a beach that is managed independently from other segments or area beaches. Implementing separate BMAs for large or heterogeneous beaches allows management decisions to be made for a specific region of the beach, rather than treating the whole beach as one unit. Each beach management area has its own beach sign(s) and is listed separately on the MHB Web site.

An initial RAM of the entire beach will help managers determine if separation of the larger beach area is warranted. Possible reasons to implement separate BMAs include, but are not limited to:

- The beach is heterogeneous and conditions vary considerably (e.g., a river mouth or storm drain on the north end of the beach increases the likelihood of bacterial pollution compared to the southern end, or an area where water quality results are not consistent throughout the entire length of beach).
- Monitoring and public notification of conditions are not practical or feasible for the entire beach.
- Sections of the beach not promoted for public use, including areas that are privately owned, not serviced by lifeguards, lack public access, or deemed unsafe for recreational purposes.
- A section of the beach is heavily used by the public compared to other areas.
- The beach has historically informal names or sections known to the public.

1. The MHB Program ranks coastal beaches into separate tiers or categories based on criteria for program participation, water quality history, beach usage, risk of pollution, etc. See MHB Tiered Monitoring Plan.

Equipment List

- Pencils/pens
- Risk Assessment Matrix
- Clipboard
- Definitions

Before heading to the field, read through the RAM and become familiarized with the process and the resources necessary to successfully complete the exercise. Obtain copies of data and reports specific to the beach management area(s) such as any previous sanitary surveys, watershed surveys, special studies, etc.

Completing the RAM

A RAM should be completed for each BMA.² The matrix should be updated frequently, typically every one to three years, depending on conditions and new information available. The frequency of updates depends on new development, increase in activities posing a risk to water quality, designated use of the waterbody, etc. The coastal surf zone is a dynamic environment where conditions can change very rapidly. Each beach management area has its own set of factors or characteristics impacting water quality, and the RAM helps to determine what those factors are.

If bacteria levels are consistently above the US EPA safety limit,³ simply examining the areas/properties directly on or adjacent to the beach may not be sufficient to thoroughly investigate all of the actual and potential sources of fecal contamination affecting the beach. Further sanitary survey work includes additional monitoring of freshwater inputs, property and septic system inspections within the watershed, and documenting offshore activities (unsanitary boating practices, dumping) contributing to poor water quality. Removing sources of bacterial pollution can lead to measurable improvements in water quality.

While completing the RAM be sure to:

- ✓ Complete all sections of the RAM as thoroughly as possible.
- ✓ Integrate the expertise and knowledge of local officials (code enforcement officers, local plumbing inspectors, planners, conservation commission members).
- ✓ Refer to the Definitions for terms used in the RAM.

Complete the Following Sections of the RAM:

I. Beach History

- ✓ Access previous years' monitoring, notification (beach posting), and environmental data to determine each criterion's point value. This information can be found from MHB Program data, sanitary surveys, special studies, and local weather monitoring stations (e.g., sewage treatment plant).
- ✓ Total the number of points and enter the sum in the **Section I. Total Points Box**.

II. Potential and Actual Sources of Contamination

- ✓ Access the appropriate data/reports and conduct on-site evaluation to obtain the information for this section.
- ✓ Fill out each segment and record individual totals. Transfer the sums to the associated boxes at the end of this section.
- ✓ Total the number of points from each segment and enter the sum in the **Section II. Total Points Box**.

2. Initially, a RAM may be completed for the entire beach which is then separated into BMAs.

3. The US EPA has deemed Enterococci bacteria as the most appropriate indicator organism for marine recreational waters. The single sample safety limit for marine waters is 104 MPN or cfus per 100 mls, 35 geometric mean value (five records within a 30-day period). For fresh water (zero salinity), the single sample limit is 61 MPN or cfus per 100 mls, and a geometric mean of 33.

III. Beach Activities and Environmental Conditions

- ✓ Access the appropriate data/reports and conduct on-site evaluation to obtain the information for this section.
- ✓ Total the number of points and enter the sum in the **Section III. Total Points Box**.

IV. Subtract Points for the Following

- ✓ Access the appropriate data/reports and conduct on-site evaluation to obtain the information for this section.
- ✓ Total the number of points and enter the sum in the **Section IV. Total Points Box**.

V. RAM Final Score

- ✓ Enter the section totals in their corresponding boxes.
- ✓ Total all of the section points and enter the final score in the **Section VI. Final Total Box**. This final RAM score will correspond with the RAM Ranking system.

RAM Ranking System

The final RAM score corresponds to a ranking or grade with associated recommendations. The beach rankings are meant as *guidelines* to help communities and resource managers assess the recreational water quality and safety of their beaches. Conditions can change very rapidly in the coastal surf zone and the RAM is simply one piece of the beach management “tool-box.”

The exercise of completing the RAM will allow beach managers to gain a better understanding of the beach area and to assist in making informed management decisions such as when to post a beach advisory or closure, or to determine whether a more thorough sanitary survey is warranted.⁴ It is a *get to know your beach* exercise.

Two examples of using the RAM in making beach management decisions:

- Bacteria results are slightly above the safety limit, there is no known safety hazard (e.g., malfunctioning septic, sewage treatment plant overflow), the conditions are not the typical “worst-case scenario” and the **Beach Ranking = A**. The beach manager may choose to wait for the resample results before posting an advisory.
- The same conditions as above, but the **Beach Ranking = D**. The beach manager may choose a more cautious approach and post an advisory or closure immediately, prior to the availability of resample results.

Beach Scores & Rankings

- A. (0-50 points) Suggested Action: Conduct routine monitoring once per week or less during the monitoring season. Resample if Enterococci results exceed the single sample safety level of 104 mpn/100 mls of sample water. Routinely update the RAM and take precautionary actions to maintain healthy conditions including routine septic system inspections, reduce runoff by planting buffers and minimizing impervious surfaces within the watershed, ensure adequate pump-out facilities for boats, etc.
- B. (51-100 points) Suggested Action: Continue to monitor at least once per week depending on the recorded bacteria levels. Additional monitoring of freshwater inputs (river mouths, streams, storm drains) during wet weather events may be warranted. Examine the relationship between bacteria levels and other parameters (e.g., rainfall, tidal stage, bather load). Education and outreach efforts should promote healthy sanitary practices at the beach and throughout the watershed.

4. Beaches with low scores may also require sanitary surveys.

- C. (101-150 points) Suggested Action: Continue to monitor at least once per week depending on the recorded bacteria levels. Additional monitoring within the watershed including storm drains, rivers, and streams may be warranted. If there is a relationship between rainfall and bacteria exceedances, precautionary wet weather advisories should be posted. Education and outreach efforts should promote healthy sanitary practices at the beach and throughout the watershed.
- D. (151+ points) Suggested Action: Increase the monitoring effort in response to recorded bacteria levels. This may require monitoring at least twice per week. Ensure that an advisory or closure is posted until monitoring results are consistently below the safety level. Consider posting additional educational signage at the beach (e.g., high bacteria levels during wet weather, do not feed waterfowl, pick up after pets, etc.). Examine all bacterial pathways to the beach. Special studies, additional data analysis, assessment of offshore activities, and sanitary surveys of properties within watershed is warranted. Identify and remediate pollution sources. Education and outreach efforts should promote healthy sanitary practices at the beach and throughout the watershed.

Maine Healthy Beaches Risk Assessment Matrix

Town or State Park: _____

Beach or Beach Management Area (BMA) Name: _____

Date of Evaluation: _____

Beach or BMA Boundaries: _____

Evaluator Name(s): _____

Title(s): _____

Address: _____

Phone: _____ Fax: _____

Email: _____

I. Beach History

1. The geometric mean for beach monitoring sites (past season):

_____ > 35 col/100mls (# sites ____ x 10 points)

_____ < 35 col/100mls (0 points for each site) _____

2. Was an "advisory" or "closure" posted during previous season due to fecal contamination?

_____ Yes (10 pts) _____ No (0 pts) _____

3. How long was the beach posted during the previous season due to elevated levels of bacteria?

_____ >16 days (20 points) _____ 11-15 days (15 points) _____ 6-10 days (8 points)

_____ 1-5 days (5 points) _____ 0 days (0 points) _____

4. Was an "advisory" or "closure" posted during the bathing season 2 years ago?

_____ Yes (5 points) _____ No (0 points) _____

5. Was an "advisory" or "closure" posted during the bathing season 3 years ago?

_____ Yes (5 points) _____ No (0 points) _____

6. Any confirmed recreational water illnesses directly related to beach water quality reported in the past 4 years?

_____ > 3 reports/year (20 points) _____ < 2 reports/year (10 points)

_____ 0 reports (0 points) _____

7. Has dry weather monitoring resulted in Enterococci scores greater than 104?

_____ Yes (10 points) _____ No (0 points) _____

8. Has wet weather or rain event monitoring resulted in Enterococci scores greater than 104?

(>1" rain in 48 hours)

_____ Yes (5 points) _____ No (0 points) _____

Section I. Total Points:

II. Potential and Actual Sources of Contamination

Impact Guidelines

- Adjacent to the beach
- Adjacent to a stream/river that empties within a mile of the beach
- Drains directly to the beach

1. Score 1 point for each of the following that impacts the beach based on impact guidelines (see above):

- | | | |
|---------------------------------------|--------------------------------------|-------|
| i. Number of Land Drains | (# of drains _____ x 1 point) | _____ |
| ii. Number of Animal Farms or Kennels | (# of farms/kennels _____ x 1 point) | _____ |
| iii. Number of Roof Gutter Drains | (# of drains _____ x 1 point) | _____ |
| iv. Number of Gray Water Drains | (# of drains _____ x 1 point) | _____ |

Segment 1 Total _____

2. Subsurface Waste Water Disposal (i.e. septic, cesspool) Systems that have not been inspected in over 3 years
(# uninspected systems _____ x 3 points) _____

3. Score 5 points for each intermittent stream flow

(# stream flows _____ x 5 points) _____

4. Score 10 points for each of the following that impacts the beach based on impact guidelines:

- | | | |
|--|-----------------------------------|-------|
| i. Waterbody on the 303d list with bacteria as a pollutant | (# waterbodies _____ x 10 points) | _____ |
| ii. Waterbody with a TMDL study for bacteria | (# waterbodies _____ x 10 points) | _____ |

Segment 4 Total _____

5. Score 15 points for each of the following that impacts the beach based on impact guidelines:

- | | | |
|---|--|-------|
| i. Stream flows, not related to rain event (may flow intermittently) | (# stream flows _____ x 15 points) | _____ |
| ii. Malfunctioning Subsurface Wastewater Disposal (i.e. septic) Systems | (# malfunctioning systems _____ x 15 points) | _____ |
| iii. Overboard Discharge Unit (OBD) | (# units _____ x 15 points) | _____ |
| iv. Marina | (# marinas _____ x 15 points) | _____ |
| v. Mooring Field | (# fields _____ x 15 points) | _____ |
| vii. Stormwater Pipe or Drain | (# pipes _____ x 15 points) | _____ |

Segment 5 Total _____

6. Score 25 points for each of the following that impacts the beach based on the impact guidelines:

i. Illegal straight pipe (# of pipes _____ x 25 points) _____

ii. Combined Sewer Overflow (CSO) (# of CSOs _____ x 25 points) _____

iii. Waste Water Treatment Plant Outfall (within 1 mile of beach)
(# of outfalls _____ x 25 points) _____

Segment 6 Total _____

Section II Segment Totals

Segment 1 Total _____

Segment 2 Total _____

Segment 3 Total _____

Segment 4 Total _____

Segment 5 Total _____

Segment 6 Total _____

Section II. Total Points:

III. Beach Activities and Conditions

1. The number of people visiting the beach throughout the season:

_____ > 150,000 visitors (10 points) _____ 50,000 - 150,000 visitors (5 points)
 _____ < 50,000 visitors (1 point) _____

2. The number of people that visit any one mile stretch of beach during the time of maximum use:

_____ > 50,000 visitors (10 points) _____ 25,000 - 50,000 visitors (5 points)
 _____ < 25,000 visitors (1 point) _____

3. Are there public restrooms located with 400' (feet) of the beach?

_____ No (25 points) _____ Yes (0 points) _____

3a. If yes, what type of public restrooms are they?

_____ Outhouse (15 points) _____ Port-a-potty (10 points)
 _____ Septic (5 points) _____ Sewered (0 points) _____

4. Are domestic animals allowed on the beach during the months of May - September?

_____ Yes (5 points) _____ No (0 points) _____

5. Are there large numbers of waterfowl regularly present on or near the beach? (e.g. flocks of birds)

_____ Yes (10 points) _____ No (0 points) _____

6. Are there wildlife areas near or adjacent (based on Section II. guidelines) to the beach watershed?

_____ Yes (15 points) _____ No (0 points) _____

7. Impervious surface scoring:

Each paved parking lot located within 100 feet (# lots _____ x 5 points) _____
 Each paved road within 500 ft of the beach (# roads _____ x 2 points) _____
 Each building roof located within 200 feet (# roofs _____ x 1 point) _____

Section III. Total Points:

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IV. Subtract Points for the Following:

- i. 5 points for each active marine vessel pump-out station within 3 miles of the beach
(# stations___ x 5 points) _____
- ii. 3 points for each property located within 200 feet
of the beach that is tied to a municipal sewer system (# properties___ x 3 points) _____
- iv. 10 points if a significant portion of the beach has a 200 foot vegetative buffer _____
- v. 5 points if beach management has posted educational signs about pollution resulting from
soiled diapers, dog feces, gull feeding, and/or advertising public restroom locations _____
- vi. 10 points if a sanitary shoreline survey has been conducted _____
- viii. 3 points if trash cans are located at the beach _____
- ix. 3 points if doggie waste bags are provided at entry points: _____
- x. 15 points for a public bathroom facility at the beach tied into a municipal sewer system _____

Section IV. Total Points:

V. RAM Final Score

Section Total Points

- I. Beach History (+) _____
- II. Sources of Contamination (+) _____
- III. Beach Uses and Conditions (+) _____

Subtotal Sections I-III

IV. Subtract Points (-) _____

Final Score

Note: See beach scores and rankings, page 3.

Definitions

303d List The 303d list identifies water quality limited waters within the state, causes and sources of nonattainment of standards, and a timetable for the development of TMDLs (Total Maximum Daily Loads) or other management processes to address attainment.

Actual v. potential pollution sources An “actual” source is one that has been documented or proven to impact water quality compared to a “potential” source which is likely impacting water quality but documentation is lacking.

Adjacent Nearby, neighboring, close.

Advisory An advisory posted on an MHB Program sign at the beach or on the Web site is a recommendation to the public to avoid water contact activities in those areas. Advisories are posted where bacteria results exceed the water quality standards for recreational water contact established by the US Environmental Protection Agency.

Analysis An examination of parts or elements and their interrelationships in making up a whole (i.e., examining patterns in rainfall and bacteria levels to determine overall beach health).

Assessment Appraisal, measure: evaluate or estimate the nature, quality, ability, extent, or significance of.

Bacteria Unicellular organisms lacking a nucleus and chlorophyll; used in MHB Program to indicate the possible presence of disease-causing organisms in recreational waters.

Beach A geological landform along the shoreline of a body of water usually consisting of unconsolidated material such as sand, gravel, cobbles, or pebbles. A marine beach is the zone of unconsolidated sand or gravel that extends landward from the mean low water line to the seaward toe of a dune. The definition of beach includes the beach face and berm. See also coastal sand dune systems.

Beach Berm Depending on the tide, this is the area mostly above water and is subject to wave activity.

Beach Management Area An entire beach or a segment of a beach that is managed independently from other beaches or segments due to potential pollution impacts or capacity of management to provide notification of water quality monitoring results.

Coastal Sand Dune System Sand and gravel deposits within a marine beach system, including, but not limited to, beach berms, frontal dunes, dune ridges, back dunes, and other sand and gravel areas deposited by wave or wind action. Coastal sand dune systems may extend into coastal wetlands. See Maine DEP Chapter 355, Coastal Sand Dune Rules.

Closure A closure, more severe than an advisory, can be based on chronic high bacteria results or when conditions greatly increase pollution levels. While it is rare in Maine to have closures, they are generally linked to known safety hazards. For example, a beach may be closed as a result of sewage treatment plant malfunctions, severe flooding, rip currents, sharks, hazardous surf conditions, and other safety hazards. A municipality must have a specific ordinance in place to close a beach.

Combined Sewer Overflows (CSO) Consist of mixtures of domestic sewage, industrial and commercial wastewaters, and stormwater runoff. Overflow may occur when the flow capacity of combined storm drains and sewer systems are exceeded during rainstorms.

Contamination General term referring to the introduction of undesirable materials (chemical, microorganisms, wastes, etc.).

Correlation Mutual relation; systematically connected.

Criteria Measurable physical, chemical, or biological characteristics commonly used as a basis for setting standards.

Elevated Raised, increased, high.

Enterococci The established bacterial indicator for designated coastal recreational waters in Maine. Indicates fecal contamination and the possible presence of pathogens.

Fecal contamination Introduction of fecal matter by contact or association into the environment.

Geometric mean Reduces the influence of outlying (i.e., the very low and very high) numbers on the data set. The data are transformed to the logarithmic values of each datum and then averaged (summed and divided by the number of terms).

Guideline A statement or other indication of policy or procedure by which to determine a course of action; standards.

Illegal Straight Pipe A man-made conduit through which liquid can flow, including pipes actively discharging untreated or partially treated sewage or “black” water, laundry or “gray” water, etc. This does not include road culverts.

Impact To have an effect.

Impervious surface Incapable of being penetrated by moisture. Impervious surfaces are mainly constructed surfaces—rooftops, sidewalks, roads, and parking lots—covered by impenetrable materials such as asphalt, concrete, brick, and stone. These materials seal surfaces, repel water, and prevent precipitation and meltwater from infiltrating soils. These surfaces cause rapid run-off of storm water and contribute to non-point source pollution.

Inactive straight pipe A conduit not in use. Signs of non-use might include: the pipe is visibly disconnected from the ground and is lying on the shore; large amounts of corrosion and rotten spots; no flow or moistness in pipe; no noticeable variation in vegetation directly under the pipe versus vegetation to either side of the pipe; no pieces of tissue in various stage of decomposition. If you are uncertain whether a pipe is active or inactive, please note this on field sheet and give explanation as to why you think it is active or inactive so that this may be followed up.

Indicator organism Indicator bacteria are used to determine water quality conditions. An indicator organism is one used to determine the presence of pathogenic (disease causing) organisms that might be present in the same environment as the indicator. The actual pathogenic organisms are too many, too difficult, and too costly to measure.

Intermittent streams Streams that may only flow at certain times of the year (usually related to spring runoff) or after large rainfall events. Generally, intermittent streams will be narrow and shallow, with varying flow rates.

Malfunctioning subsurface wastewater disposal systems (i.e., septic, cesspool) Are of primary concern due to public health issues. You can usually tell a malfunctioning system by: odor; presence of wetland plant species such as cattails in an otherwise normal vegetation area; seepage from the tank or leach field area; mushy areas above the system; indents in the ground or other signs that the cover or tank might have collapsed.

Marine vessel pump-out station Provides a safe and legal method for disposing of human sanitary waste from vessel marine sanitation devices (i.e., storage tanks).

Monitor To check, keep records of.

Monitoring Season Period of time swim beach samples are collected to correspond with public use of recreational water; varies from one beach to another as weather and water temperature vary greatly from region to region; for most beaches in Maine, this is Memorial Day through Labor Day.

Non-point source pollution Indirect contamination (i.e., urban/agricultural runoff); many diffuse sources as compared to point source (i.e., straight pipe).

Overboard Discharge (OBD) A discharge of sanitary wastewater from residential, commercial, and publicly-owned facilities to streams, rivers, and the ocean. Since these are point discharges, they are required to be licensed by the state, and are currently being phased out by the Department of Environmental Protection.

Pathogen Any disease-causing agent, especially a bacterium or other microorganism.

Point-source pollution Direct contamination (i.e., via effluent pipe/smoke stack) as compared to non-point source (i.e., storm runoff).

Pollution The presence of harmful contaminants in the environment.

Posting Placement of a sign(s) at beach access points; making information available to the public through Web site, hotline, or other means.

Recreational waterborne illness Illness spread by swallowing, breathing, or having contact with contaminated water from swimming pools, spas, lakes, rivers, or oceans. Recreational water illnesses can cause a wide variety of symptoms, including gastrointestinal, skin, ear, respiratory, eye, neurologic, and wound infections. Diarrhea is the illness most commonly reported to the Maine CDC.

Risk assessment matrix (RAM) A preliminary assessment of potential and/or actual pollution sources on or directly adjacent to the beach. The RAM will assist beach managers in making well-informed beach management decisions, in conjunction with routine monitoring to build a “profile” of each BMA and to determine the need for an in-depth sanitary survey of the shoreline and adjacent watershed area(s).

Risk Exposure to possible danger, loss, or injury.

Sanitary survey The goal of a sanitary survey is to identify, document, and eliminate sources of fecal contamination affecting water resources (e.g., coastal beaches, shellfish growing areas, and freshwater inputs to these areas).

Sewage Potential source of microbiological contamination of recreational waters. May be associated with system failures in human sewage treatment facilities, leaking sewer lines, septic systems, or with rainfall and resulting surface water runoff.

Special Study Any monitoring, research, and data analysis conducted beyond the routine Enterococci monitoring of beaches. Typically, special studies are conducted in areas with chronic bacteria issues.

Standard operating procedure (SOP) Officially approved document describing prescribed techniques. Accepted method of performance.

TMDL (total maximum daily load) study Identifies the amount of a pollutant the receiving water can assimilate without violating water quality criteria or impairing the designated use. It is the loading capacity of a waterbody including a margin of safety to account for uncertainty in target-setting.

Vegetative buffer Undeveloped area directly adjacent to a body of water. Reduces runoff, stabilizes soils, provides habitat, etc.

Wastewater treatment plant Also referred to as a publicly-owned treatment works (POTW), a sanitary sewer collection and treatment system.

Watershed The upland land mass which drains to a particular waterbody.

Water quality criteria Specific levels of pollutants, which, if reached or exceeded, are expected to render a body of water unsuitable for its designated use; may adversely affect human health or aquatic life. Unenforceable guidelines issued by a governmental institution or other agency.